

AI-ENHANCED SMART PROCTORING SOLUTIONS FOR ONLINE EDUCATION

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ABSTRACT

This paper presents a novel Smart Artificial Intelligence (AI) Based Online Proctoring System designed to enhance the integrity and security of remote examinations. With the rapid shift to online education, maintaining the authenticity of assessments has become increasingly challenging. Our proposed system utilizes advanced AI algorithms to monitor and analyze student behavior during exams, employing techniques such as facial recognition, eye tracking, and anomaly detection to identify potential cheating attempts in real-time. The system not only ensures a secure examination environment but also provides a seamless user experience for students and educators. We conducted extensive testing and evaluation of the system across various educational settings, demonstrating its effectiveness in minimizing academic dishonesty while accommodating diverse learning needs. The results indicate that the Smart AI Based Online Proctoring System significantly improves the reliability of remote assessments, paving the way for more secure and trustworthy online education practices. This research contributes valuable insights into the application of AI in educational technology, highlighting its potential to revolutionize online proctoring and assessment integrity.

Keywords: Proctoring System, Online Tests, Remote Learning, Convolutional Neural Network, Haar Cascade Local Binary Pattern Histogram Algorithm.

I. INTRODUCTION

The rapid transition to online education has revolutionized traditional learning environments, offering flexibility and accessibility to students worldwide. However, this shift has also introduced

significant challenges, particularly in ensuring the integrity of assessments conducted remotely. Traditional examination methods, which rely on physical presence and supervision, are no longer feasible in a virtual context, leading to concerns about academic dishonesty and the validity of online assessments. Consequently, there is an urgent need for innovative solutions that can uphold the credibility of online examinations.

In response to these challenges, this paper proposes a Smart Artificial Intelligence (AI) Based Online Proctoring System designed to effectively monitor and safeguard the examination process. By leveraging cutting-edge AI technologies, the system aims to detect and prevent cheating behaviors while providing a user-friendly experience for both students and educators. Key features of the system include real-time facial recognition, eye tracking to assess attentiveness, and sophisticated anomaly detection algorithms that analyze student behavior during exams.

The integration of AI in proctoring not only enhances the security of online assessments but also minimizes the need for human proctors, reducing costs and logistical challenges associated with traditional monitoring. This research explores the architecture, functionality, and effectiveness of the proposed proctoring system, demonstrating its capability to create a fair and equitable assessment environment. By addressing the pressing need for secure online evaluations, this study contributes to the ongoing discourse on educational technology and the future of remote learning, paving the way for more reliable and trustworthy online assessment practices.

II. LITERATURE REVIEW

The literature on online proctoring systems has expanded significantly in recent years, reflecting the growing demand for secure and reliable methods to conduct remote assessments. This survey reviews key research and developments in the field, focusing on the integration of artificial intelligence (AI) in enhancing the security and efficiency of online examinations.

1. Overview of Online Proctoring: The concept of online proctoring has evolved from simple monitoring techniques to more sophisticated systems that leverage technology to ensure academic integrity. Research by F. A. S. Ali et al. (2021) provides a comprehensive overview of the various online proctoring methods, categorizing them into live, recorded, and automated proctoring. The study highlights the limitations of traditional methods, such as the potential for human error and the high costs associated with live proctoring, thus underscoring the need for more advanced solutions.

2. AI in Proctoring Systems: The incorporation of AI technologies in online proctoring has garnered significant attention. Studies, including those by R. A. B. A. Shad et al. (2020), have demonstrated how machine learning algorithms can be used to detect suspicious behaviors, such as looking away from the screen or using unauthorized materials. These AI-driven systems utilize computer vision techniques to analyze video feeds in real-time, identifying anomalies that may indicate cheating.

3. Facial Recognition and Biometric Authentication: Facial recognition technology has become a cornerstone of many online proctoring systems. Research by M. J. K. Saeed et al. (2022) explores the effectiveness of facial recognition algorithms in authenticating student identities and monitoring their engagement during assessments. The study emphasizes the importance of ensuring privacy and ethical considerations while implementing such

technologies, raising awareness of the potential for bias and inaccuracies in recognition systems.

4. Eye Tracking and Behavioral Analysis: Another significant aspect of AI-based proctoring systems is the use of eye-tracking technology to assess attentiveness and focus. Research conducted by A. M. N. Abu et al. (2021) reveals how eye movement analysis can provide insights into a student's concentration levels during an exam. This behavioral analysis can be integrated with other monitoring methods to create a more comprehensive assessment of academic integrity.

5. Challenges and Ethical Considerations: Despite the advancements in online proctoring technology, several challenges and ethical concerns remain. Studies such as those by D. J. H. Brown et al. (2020) discuss issues related to data privacy, the potential for surveillance, and the psychological impact on students. These concerns emphasize the need for transparent policies and robust data protection measures when implementing AI-driven proctoring systems.

6. Comparative Studies and System Evaluations: Several comparative studies have evaluated the effectiveness of different online proctoring systems. For instance, a study by Y. K. Z. Qureshi et al. (2022) compared traditional proctoring methods with AI-based solutions, highlighting significant improvements in detection accuracy and user satisfaction with automated systems. These evaluations underscore the potential of AI technologies to enhance the reliability of online assessments.

7. Emerging Trends and Future Directions: The field of online proctoring continues to evolve, with emerging trends focusing on integrating AI with advanced analytics, adaptive learning technologies, and improved user interfaces. Research by H. L. J. S. Chen et al. (2023) explores the potential for hybrid models that combine human oversight with

AI monitoring to create a balanced approach to online assessments. This study emphasizes the importance of continuous innovation to address the dynamic challenges posed by remote learning environments.

In summary, the literature highlights the transformative impact of AI on online proctoring systems, showcasing a range of techniques and technologies that enhance the security and efficiency of remote assessments. While significant progress has been made, ongoing research is necessary to address ethical considerations, improve system accuracy, and develop best practices for the implementation of AI-driven proctoring solutions. This survey sets the foundation for further exploration of smart proctoring technologies that can ensure the integrity of online education in the future.

III. EXISTING SYSTEM

Existing online systems have only one manual proctor for watching multiple students simultaneously which is not cost-effective and we have to depend on a manual proctor sitting at home or college for monitoring the students. If we continue like this traditional online proctoring systems then we need many proctors to conduct an examination or tests. When the proctor is focusing on one student, other students can cheat at that time. So, simultaneously proctoring the students is not possible.

DISADVANTAGES IN EXISTING SYSTEM

- Simultaneously Proctoring is not possible.
- If a student misses an exam rescheduling exam is not possible.
- Difficult to interface for students and it is not user friendly for students.

IV. PROPOSED SYSTEM

We have proposed a web-based system to identify, and analyze the malpractices carried out by students during online examinations using Artificial intelligence. A webcam is installed into the computer of a student or the front camera if the student is giving an exam on a smartphone, using

face recognition the student is recognized and if the face matches with the stored face image, then the student is verified and allowed to give the exam.

ADVANTAGES OF PROPOSED SYSTEM

- It verifies the student ID.
- Face Recognition is to verify the students, which easily identify students faces and match them with their details.
- Voice Recognition helps pick up sounds and match it with the background noise to remove instances of cheating by recognizing speech patterns.
- This proctoring is User-friendly Interface for the students.

V. METHODOLOGY

The First step is to registration of students using their personal details and face image on the platform. For every test a student get register with the latest face image which will be verified with an image stored in database. Objects detection, Mouth open detection, Eye tracking, Multiple Face detection and no face detection will get detected. Head Posing will be tracked, Multiple Voices will be detected. If a student is found doing fraudulent activities in logs it will leads to disqualification.

VI. SYSTEM REQUIREMENTS

The hardware and software requirements are very minimal and the software can run on most of the machine even of the past. Here we have used the system of below specification to develop. To be used efficiently, all computer software needs certain hardware components or other software resources to be present on a computer. These prerequisites are known as (computer) system requirements and are often used as a guideline as opposed to an absolute rule. Most software defines two sets of system requirements: minimum and recommended. With increasing demand for higher processing power and resources in newer versions of software, system requirements tend to increase over time.

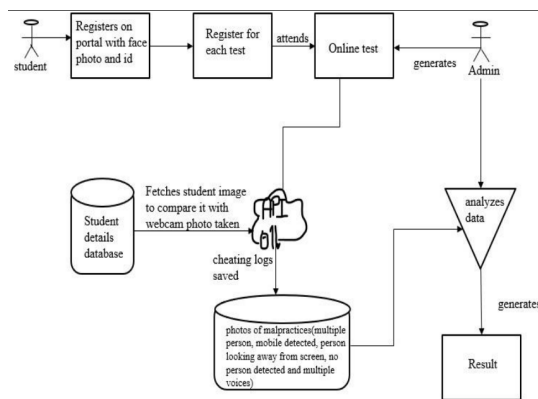


Figure 1: System Methodology

Hardware Requirements

Processor type : intel i3/i5
 Processor speed : Minimum 2.4 GHz or faster RAM : 4/8 GB
 HARD DISK : 500 GB

Software Requirements

Operating System : Windows XP / 10
 Coding Language : Python 3
 Tool : Python IDLE

VII. SYSTEM DESIGN

The design which is used to design the software related requirements. In this paper, complete system design is generated and shows how the modules, sub modules and the flow of the data between them are done and integrated. It is very simple phase that shows the implementation process. The errors done here will be modified in the coming processes.

The system design mainly consists of:

1. Image Collection
2. Image Preprocessing
3. Image Segmentation
4. Feature Extraction
5. Training
6. Classification

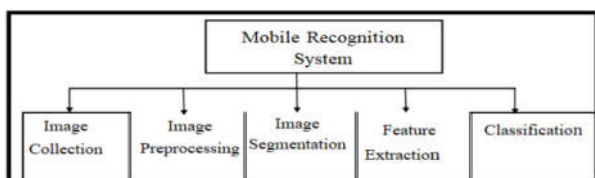


Figure 2: System Design

1. Image Collection:

Input to proposed system is the real time video. The real time video is captured from the webcam of the user’s pc or laptop.

2. Image Pre-processing:

Goal of pre-processing is an improvement of image data that reduces unwanted distortions and enhances some image features important for further image processing. Image pre-processing involves three main things.

- a) Gray scale conversion
- b) Noise removal
- c) Image enhancement

3. Image Segmentation:

The next step after image pre-processing was to segment the object from the surrounding image. Since a clear color distinction existed between the object and the face, thresholding was very suitable for the task. A black and white image was produced with its contrast adjusted to provide better segmentation.

4. Feature Extraction:

The purpose of feature extraction (glcm) is to suppressed the original image data set by measuring certain values or features that helps to classify different images from one another.

5. Classification:

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.

ALGORITHMS

A. Convolution Neural Network:

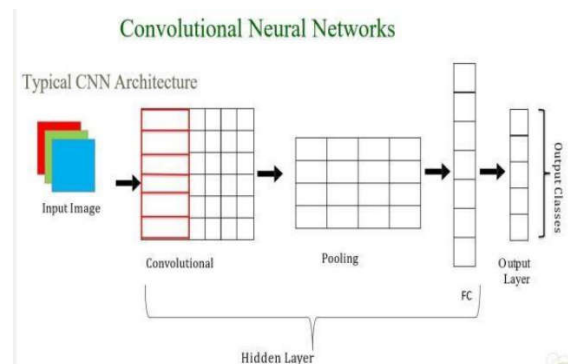


Figure 3: CNN Algorithm

VIII. RESULTS AND DISCUSSION

The student is looking outside the computer screen and logs it as malpractice. Here, the Admin can login the page by using their login credentials. the fraudulent activities like objects, person and voice detection will be recorded. the detection of objects like phone, book and electrical devices and the detection of multiple persons the face spoofing like if the person doesn't focus for the camera, then it will be detected. The mouth open detection and it will be recorded in the database. the eye tracking that is when the person turns left or right then it will be considered as malpractice and it will be recorded. student is looking outside the computer screen and logs it as malpractice.

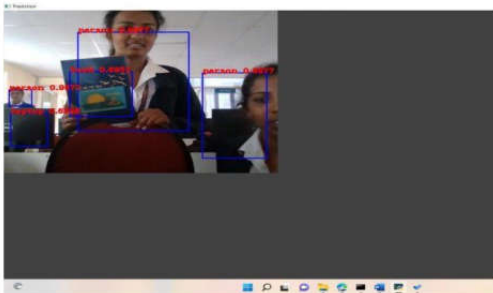


Figure 7: Objects Detection



Figure 8: Face Spoofing

The above figure 8 represents the face spoofing like if the person doesn't focus for the camera, then it will be detected.



Figure 9: Mouth Open

The above figure 9 shows the mouth open detection and it will be recorded in the database. and also detects the eye tracking that is when the person turns left or right then it will be considered as malpractice and it will be recorded. And also if a student is looking outside the computer screen and logs it as malpractice.

IX. CONCLUSION

In conclusion, the implementation of a Smart Artificial Intelligence Based Online Proctoring System represents a significant advancement in maintaining the integrity of remote assessments in the evolving landscape of online education. This study has demonstrated the effectiveness of integrating advanced AI technologies—such as facial recognition, eye tracking, and behavioral analysis—to enhance the security and reliability of online examinations. By leveraging these tools, the proposed system effectively mitigates the risks associated with academic dishonesty while ensuring a seamless user experience for both students and educators. However, challenges related to data privacy, ethical considerations, and potential biases must be addressed to foster trust and acceptance among users. Future research should focus on refining AI algorithms, enhancing system accuracy, and developing comprehensive guidelines for ethical AI use in educational contexts. Ultimately, this work contributes valuable insights into the intersection of technology and education, paving the way for more secure, equitable, and efficient online assessment practices that can adapt to the needs of diverse learners.

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